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Resultaten van 'business-oriented' SPI-onderzoek

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'Business orientation'

Drie invalshoeken:

- Management-informatie om SPI-effectiviteit te beoordelen
- Verbeteren, uitgaande van het bedrijfsbelang
- Focus op de kwaliteit van specialisten

Resultaten van drie onderzoekprojecten

- Targets, Drivers and Metrics in SPI (Philips - TU/e global survey)
- Improvement Space for Software Development organisations (Qualityhouse – Metrific- TU/e)
- Beoordeling van competenties van ICT-adviseurs (EGEM/ICTU - KEMA – TU/e)

Targets, Drivers and Metrics in Software Process Improvement, results of a survey in a multinational organisation

(to be published in the Software Quality Journal, 2006).

Survey demographics - 1

Continent	Number of software groups
Europe	32
Asia	8
America	9
Total	49

Distribution of responding software groups over the continents

Survey demographics - 2

CMM- level	Number of groups	Valid percentage	Cumulative percentage
1	20	43,5	43.5
2	13	28,3	71.7
3	10	21,7	93.3
4	0	0	93.3
5	3	6,5	100.0
Not reported	3		
Total	49		

Numbers of software groups on the CMM levels

Results of the survey-1

Improvement target	**Mean: attention given**				**Mean: perceived performance**			
	All	cmm1	cmm2	cmm3	all	cmm1	cmm2	cmm3
increase predictability	3.8	3.6	3.7	4.3	2.9	2.3	3.2	3.5
reduce defects	3.5	3.1	3.4	4.4	2.7	2.3	3.1	3.0
increase productivity	3.0	3.1	2.5	3.3	2.3	2.2	2.1	2.8
reduce lead time	2.9	2.7	2.8	3.2	2.1	1.9	2.2	2.3
improve cooperation	2.7	2.7	3.2	2.4	2.4	2.4	2.4	2.5
improve staff motivation	2.4	2.1	2.7	2.5	2.4	2.3	2.5	2.4
increase reusability	2.1	1.8	2.2	2.6	2.0	1.7	2.4	2.1

Results of the survey-2

Improvement driver – average scores	**Mean**			
	all	CMM1	CMM2	CMM3
commitment of engineering management	4.0	3.7	4.0	4.7
commitment of development staff	3.8	3.6	3.8	4.0
sense of urgency	3.5	3.6	3.2	3.5
availability of engineers time for SPI	3.4	3.6	3.4	3.1
commitment of business management	3.3	3.3	3.0	3.5
availability of qualified SPI resources	3.3	3.2	3.0	3.9
clear / quantifiable improvement targets	3.2	2.8	3.2	3.7
use of accepted framework such as CMM	3.1	2.5	3.6	3.9
clear relation between SPI / business goals	3.1	2.7	3.8	3.3
confidence in SPI results	3.0	2.9	2.8	3.6
visibility of intermediate results	2.9	2.8	2.7	3.4
sufficient investment in SPI training	2.8	2.6	2.5	3.7
proper tooling to support the processes	2.8	2.6	3.1	2.7
cooperation other engineering disciplines	2.6	2.3	3.0	2.6
integration SPI in general improvement actions	2.5	1.9	3.2	3.0

Results of the survey-3

Metrics usage	**% of groups using the metric**			
	all	CMM1	CMM2	CMM345
actual effort spending	**82.6%**	57.9%	100.0%	100.0%
size	**69.6%**	63.2%	53.8%	90.0%
lead time	**65.2%**	57.9%	69.2%	90.0%
schedule metrics	41.3%	21.1%	38.5%	80.0%
staff competence level	39.1%	31.6%	38.5%	60.0%
staff attrition	37.8%	31.6%	53.8%	33.3%
test coverage/requirements related	37.0%	42.1%	15.4%	50.0%
fault density pre-release	32.6%	31.6%	7.7%	70.0%
fault severity distribution	30.4%	31.6%	7.7%	50.0%
fault density post-release	28.3%	21.1%	15.4%	60.0%
cumulative failure profile	28.3%	31.6%	7.7%	50.0%
test coverage/code related	21.7%	26.3%	15.4%	30.0%
re-use metrics	17.8%	15.8%	23.1%	22.2%
mean time to failure	17.4%	15.8%	0.0%	30.0%
requirements metrics	15.2%	10.5%	7.7%	30.0%
time to spec	13.3%	10.5%	23.1%	10.0%
cyclomatic complexity	0.0%	0.0%	0.0%	0.0%

Some main conclusions

- Quite some consensus on improvement targets
- Most important drivers for SPI are ‘commitment’ drivers, in particular ‘engineering management commitment’.
- CMM level 2 software groups focus more on project management metrics. Level 3, 4, 5 groups add to this product metrics.
- Software groups on higher levels are making significantly more use of metrics.

Improvement Space for Software Development Organisations

(published at ICEIS06 Cyprus and in Informatie 2006)

Research question

How to improve the effectiveness of Software Process Improvement programmes/activities (CMM-I)?

Research approach

- Recognise both internal and external factors that influence software process improvement
- Investigate these factors on the basis of empirical research in 11 representative software development organisations
- Point out the improvement space for these organisations

Research approach:

SPI needs to take into account both *internal* and *external* factors

CMM-I: *internal* orientation: maturity levels, KPA's, measurement of internal processes

External factors: Market dynamics, Customer behavior, Competitors, Governmental regulations, etc.

How to identify *internal* and *external* factors, and how to use them to point out directions for process improvement?

Entropy

Entropy is a concept that expresses the disorder of a system (Boltzman, 2000).

A low entropy means a high level of order, structure and stability, in a system.

A high entropy means a low, or even chaotic, level of order in a system

Internal entropy: entropy of the internal organisation (system)

External entropy: entropy of the (direct) environment of the organisation (sytem)

High and low external and internal entropy

High external entropy	Low external entropy
Environment is unstable and unpredictable	Environment is stable and predictable (relatively low dynamics)
Few regulations (e.g. governmental, IT-standards)	Strongly regulated, and standardised
High internal entropy	Low internal entropy
Flexibility is key (e.g. dynamic environment, quick adaption to changing circumstances)	Standardisation is important
Organisational processes are often executed in different ways	Organisational processes are executed in a formal and predictable way (restricted complexity)

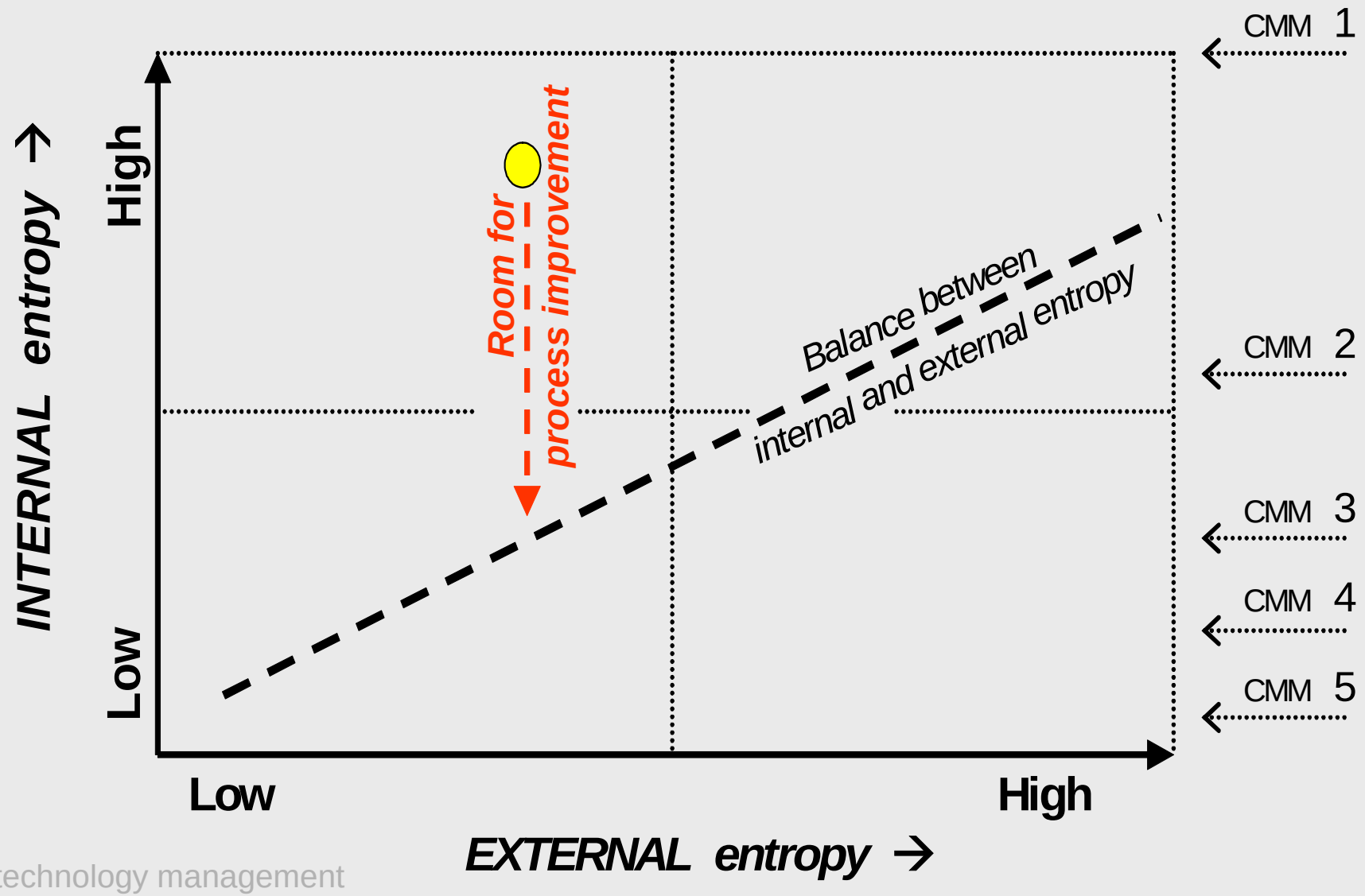
Entropy and its relations with business complexity and dynamics

Entropy		Complexity			
		Low	Average-Low	Average-High	High
Dynamics	Low	Low	Low	Average-Low	Average-Low
	Average-Low	Low	Average-Low	Average-Low	Average-High
	Average-High	Average-Low	Average-High	Average-High	High
	High	Average-High	Average-High	High	High

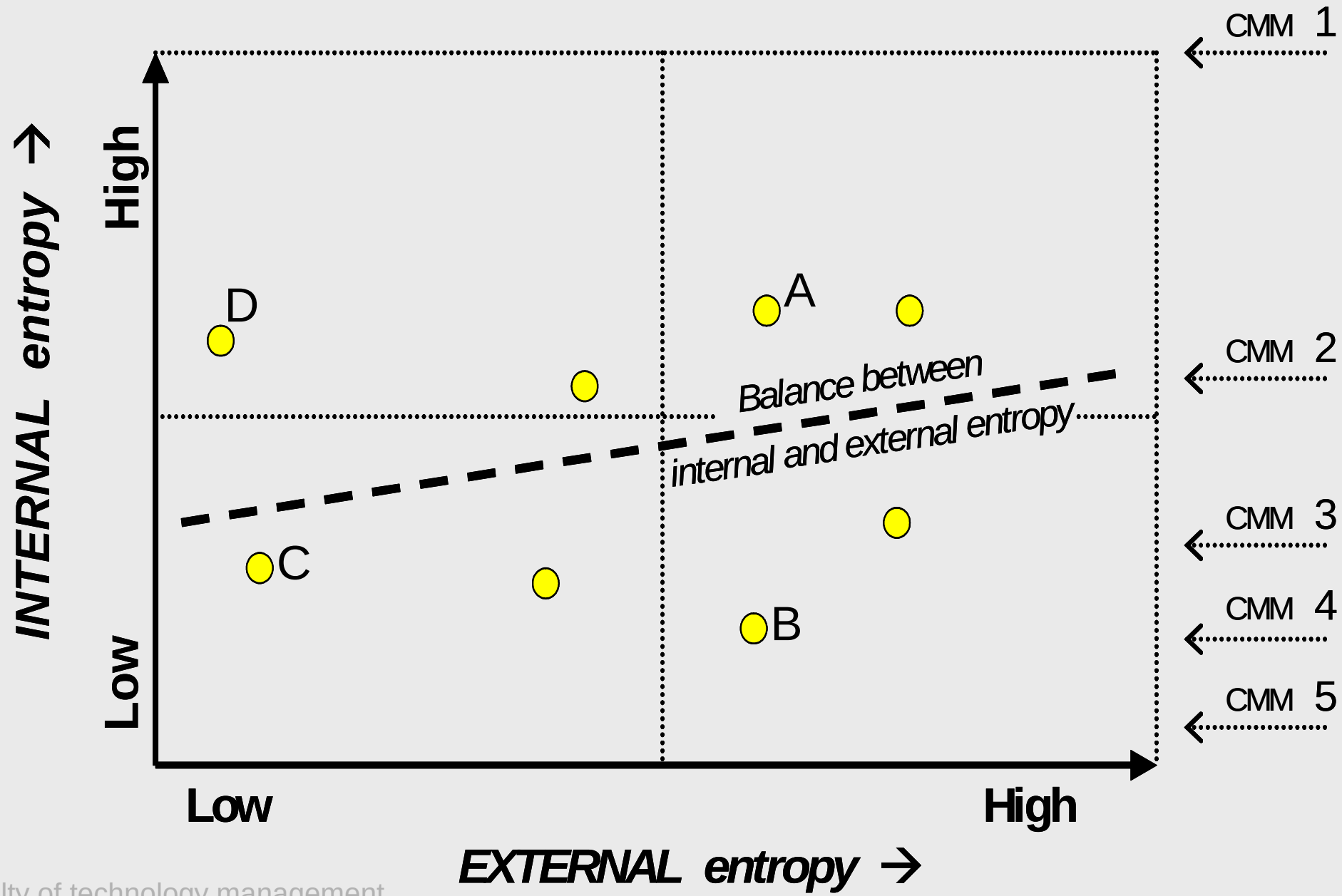
Determination of external and internal entropy: from business aspects to complexity and dynamics

		Sub aspect	Complexity	Dynamics
External entropy	Market	Product, Design, Architecture		
Internal entropy	Organisation	Process and Structure		
	Factory	People, Resources and Technology		

Directions for improvement



Positioning organisations based on empirical research



Complexity and dynamics of organisation A
(High internal and high external entropy)

Organisation A	Complexity	Motivation	Dynamics	Motivation
Market	H	Various products for various markets	H	Product portfolio changes rapidly
Organisation	H	Many interrelations with suppliers	H	Many changes in collaborative processes
Factory	H	Large diversity in resources and people (skills)	H	Emerging new technologies

Complexity and dynamics of organisation C
(Low internal and low external entropy)

Organisation C	Complexity	Motivation	Dynamics	Motivation
Market	L	Stable and mature market with restricted product portfolio	L	Long lead time per product
Organisation	M	High level of maturity of business processes	LL	Rather stable processes, only few changes per time interval
Factory	H	High level of standardisation of all resources is a necessity	L	Few changes in resources to be applied

Conclusions

Software Process Improvement should take into account external business factors to point out directions for improvement activities

Entropy, both internal and external, of organisations can be quantitively measured

Internal and external entropy measurements can be used to position an organisation in an 'improvement space', and serve to point out directions for improvement

Beoordeling van competenties van ICT-adviseurs

(EGEM/ICTU - KEMA – TU/e)

Vraag- en doelstelling

Gemeenten:

- een overload aan initiatieven op het gebied van de e-overheid leidt tot stagnatie in de realisatie.
- behoefte aan concrete ondersteuning bij de invoering van deze projecten (wordt gegeven door Ministerie van Binnenlandse Zaken).

EGEM-i:

- ondersteunt de invoering van de elektronische overheid binnen gemeenten door het bieden en faciliteren van professionele ondersteuning op maat.
- maakt hiertoe gebruik van professionele en deskundige adviseurs die passen binnen de filosofie en visie van EGEM-i.
- adviseurs dienen op basis van zorgvuldig gespecificeerde criteria te worden geselecteerd

Selectie van ICT-adviseurs: norm-ontwikkeling

Ontwikkeling van een norm voor het borgen van:

- de selectiecriteria
- de selectieprocedure

door een onafhankelijke instantie in samenwerking met belanghebbenden

Ontwikkeling van de norm op basis van risico-analyse

Specificeren en kwantificeren van selectiecriteria

- Resultaatgebieden
  - Opleidingen
  - Ervaring
- Competenties
  - Geloofwaardigheid en integriteit
  - Klantgerichtheid
  - Mondelinge communicatie
  - Analytisch vermogen
  - Conceptueel vermogen
  - Beïnvloeden
  - Inlevingsvermogen
  - Plannend en organiserend vermogen
  - Functionele expertise

Toepassing van de selectiecriteria (de norm)

- Aanmelding van adviseurs, inzenden bewijsmateriaal om aan te tonen dat aan de norm wordt voldaan (incl. referenties)
- Beoordeling, eventueel nader onderzoek, steekproefsgewijze, op basis van verstrekte referenties
- Bij acceptatie: specifieke training door EGEM-i
- Bij goed gevolg: toewijzen van een project bij de overheid (gemeente)

- Stand van zaken: momenteel 20 adviseurs beoordeeld (verwachting: ca. 150 de komende maanden).

Conclusies

Drie ontwikkelingen nader bekeken:

- management streeft (met succes) naar beheersing SPI-inspanningen
- men krijgt (meer) oog voor zowel interne als externe factoren die de effectiviteit van SPI bepalen
- noodzakelijke competenties van ICT-adviseurs worden expliciet gemaakt, en gehanteerd bij selectie van adviseurs